

AD-A033 642

AEROSPACE MEDICAL RESEARCH LAB WRIGHT-PATTERSON AFB OHIO F/G 1/3
USAF BIOENVIRONMENTAL NOISE DATA. VOLUME 59. QU-22B IN-FLIGHT C--ETC(U)
NOV 75 J F ROSE, N A FARINACCI

UNCLASSIFIED

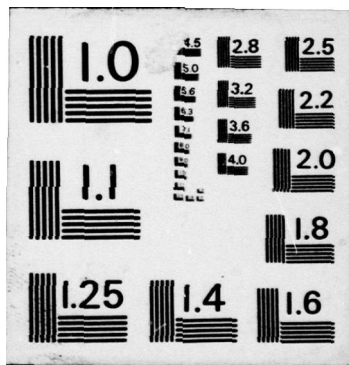
AMRL-TR-75-50-VOL-59

NL

1 OF 1
AD-A
033 642



END
DATE
FILMED
2-4-77
NTIS



U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

AD-A033 642

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK
VOLUME 59. QU-22B IN-FLIGHT CREW NOISE

AEROSPACE MEDICAL RESEARCH LABORATORY,
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

NOVEMBER 1975

ADA033642

364120

AMRL-78-50
Volume 59



USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

Volume 59 QU-22B IN-FLIGHT CREW NOISE

NOVEMBER 1975



Approved for public release; distribution unlimited

AEROSPACE MEDICAL RESEARCH LABORATORY
AEROSPACE MEDICAL DIVISION
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

NOTICES

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related Government procurement operation, the Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise, as in any way, or license, use holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Please do not request copies of this report from Aerospace Medical Research Laboratory. Additional copies may be purchased from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Federal Government agencies and their contractors registered with Defense Documentation Center should direct requests for copies of this report to:

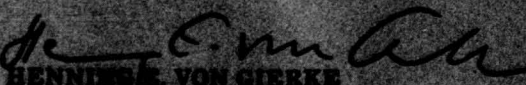
Defense Documentation Center
Cameron Station
Alexandria, Virginia 22314

TECHNICAL REVIEW AND APPROVAL

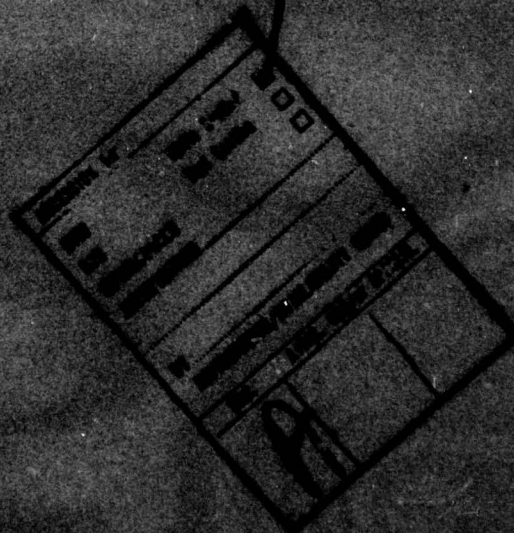
This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER


BENNING E. VON GIERKE
Director
Biodynamics and Bionics Division
Aerospace Medical Research Laboratory

AIR FORCE - 1 SEPTEMBER 74 - 200



SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AMRL-TR-75-50, Vol. 59	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK: QU-22B In-flight Crew Noise	5. TYPE OF REPORT & PERIOD COVERED Volume 59 of a series	
	6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s) Justus F. Rose, Jr., Col, USAF Nick A. Farinacci, Capt, USAF, BSC	8. CONTRACT OR GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Aerospace Medical Research Laboratory Aerospace Medical Division, Air Force Systems Command, Wright-Patterson AFB, OH 45433	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62202F 7231-04-18	
11. CONTROLLING OFFICE NAME AND ADDRESS Same as above	12. REPORT DATE November 1975	
	13. NUMBER OF PAGES 15	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Noise Noise Environments Bioenvironmental Noise In-flight Crew Noise QU-22B Aircraft		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The QU-22B is a USAF light utility aircraft used for infiltration surveillance. This report provides measured data defining the bioacoustic environments at flight crew locations inside this aircraft during normal flight operations. Data are reported for one location in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of		

personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

ia

PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 72310418, Measurement of Noise and Vibration Environments of Air Force Operations. Col Justus F. Rose, Jr. conducted the field measurements and performed the data analysis; Capt Nick Farinacci prepared this report.

The authors acknowledge the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.

Table of Contents

	<i>Page</i>
INTRODUCTION	3
IN-FLIGHT NOISE	4

List of Tables

1. Measurement Location and Test Conditions for Noise Measurements	4-5
2. Measured Sound Pressure Level 1/3 Octave Band	6-7
Octave Band	8-9
3. Measures of Human Noise Exposure	10-11

INTRODUCTION

The QU-22B is a USAF light utility aircraft used for infiltration surveillance. This aircraft, which is manufactured by the Beech Aircraft Corporation, is powered by one GTSIO-520-G reciprocating engine rated at 375 hp at 3,400 rpm maximum take-off power. The engine drives a Hartzell three-blade constant-speed, slow-turning, quiet, 2.29 m diameter propeller through a 0.6667 gear reduction. The engine is manufactured by the Teledyne Continental Motors Corporation.

This volume provides measured data defining the bioacoustic environments produced inside this aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the QU-22B aircraft.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. *Refer to Volume 1* (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., in-flight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; Autovon 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

-
1. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

IN-FLIGHT NOISE

MEASUREMENTS

All noise measurements were made on-board a standard-configured QU-22B aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard QU-22B environments, but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at one flight crew location. Table 1 lists the measurement location and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone was randomly moved external to the headgear in a region 0.2-0.3 meter from the head and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level that effectively smooths out short-duration fluctuations and best describes the exposure.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the QU-22B aircraft at the specified location. This table includes the overall, 1/3 octave band, and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1
MEASUREMENT LOCATION AND TEST CONDITIONS

QU-22B, Eglin AFB, 29 Jul 1971
Serial # 69-7704

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Right Seat	Seated Head Level
CONDITION	DESCRIPTION	
A	Engine start, right door open.	
B	Taxiing — 20" Hg. Manifold Pressure, 1500-2000 RPM, doors closed.	
C	Engine check — 23" Hg. Manifold Pressure, 2100 RPM.	
D	Takeoff — 37" Hg. Manifold Pressure, 3400 RPM.	
E	Initial acceleration — gear and flaps up, 37" Hg. Manifold Pressure, 3400 RPM.	
F	Climb — 37" Hg. Manifold pressure, 3400 RPM, 100 KIAS, 800' / , 4-500'/min rate of climb.	
G	Same as F — 3500' / , 300'/min rate of climb.	
H	Climb — 35" Hg. Manifold Pressure, 3400 RPM, 8.0M PA /.	
I	Normal cruise — 32" Hg. Manifold Pressure, 2900 RPM, 130 KIAS, 9.5M PA.	
J	Orbit cruise — 29" Hg. Manifold Pressure, 2900 RPM, 130 KIAS, 9.5M PA.	
K	Gear down descent — 25" Hg. Manifold Pressure, 2500 RPM, 150 KIAS, 9.5M PA ~ , 2000'/min rate of descent.	
L	Clean descent — 29" Hg. Manifold Pressure, 2900 RPM, 200 KIAS, 4000'/min rate of descent.	
M	140 KIAS, 31" Hg. Manifold Pressure, 2900 RPM, 5.0M PA.	

TABLE 1 (Continued)

MEASUREMENT LOCATION AND TEST CONDITIONS

QU-22B, Eglin AFB, 29 Jul 1971

Serial # 69-7704

<i>POSITION</i>	<i>DESCRIPTION</i>
N	Dog Leg to GCA pattern — 31" Hg. Manifold Pressure, 3400 RPM, 140 KIAS, 4.0M PA.
P	GCA pattern, base turn — 26" Hg. Manifold Pressure, 3400 RPM, 2.3M PA, 130 KIAS.
Q	Glide path — 32" Hg. Manifold Pressure, 3400 RPM, 105 KIAS, gear down, flaps 20%.
R	GCA final approach — 27" Hg. Manifold Pressure, 3400 RPM, 110 KIAS, 1.3M PA, gear down, flaps 20%.
S	VFR overhead traffic pattern — 32" Hg. Manifold Pressure, 3400 RPM (bleed to 23" Hg. in nitchout).
T	VFR final approach — 15" Hg. Manifold Pressure, 2800 RPM, gear down, flaps 20%.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											IDENTIFICATION:	
1/3 OCTAVE BAND												
NOISE SOURCE/SUBJECT:											OMEGA 3.2	
QU-22B AIRCRAFT											TEST 71-014-056	
INFLIGHT NOISE LEVELS											RUN 01	
											10 JAN 75	
											PAGE F1	
LOCATION/CONDITION												
FREQ (HZ)	1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J		
25	96	94	104	99	94	95	94	94	91	91	91	
31.5	103	103	104	105	99	99	99	98	97	97	96	
40	105	107	106	108	101	98	98	97	93	93	93	
50	96	96	100	96	95	95	93	92	90	91	91	
63	95	94	99	95	92	93	92	91	93	93	93	
80	94	96	94	100	100	102	101	102	104	100	100	
100	96	93	109	104	105	108	108	106	116	109	109	
125	100	103	96	101	100	105	103	100	103	101	101	
160	89	95	99	105	107	103	102	98	103	102	102	
200	90	93	91	97	99	99	100	96	104	104	104	
250	88	87	94	103	103	104	107	100	98	97	97	
315	79	81	84	95	94	93	93	93	94	91	91	
400	77	77	83	96	93	93	93	90	93	90	90	
500	79	78	80	89	90	90	91	90	92	90	90	
630	76	76	78	90	92	91	91	91	92	89	89	
800	75	71	76	87	89	89	89	88	88	86	86	
1000	73	70	75	81	83	85	84	84	85	84	84	
1250	71	68	73	79	81	83	81	81	82	81	81	
1600	69	66	70	78	79	83	79	80	81	79	79	
2000	69	67	72	79	80	83	81	81	83	82	82	
2500	66	65	68	76	77	79	78	78	82	79	79	
3150	64	63	66	74	75	79	77	77	81	79	79	
4000	63	63	66	74	75	78	77	77	83	80	80	
5000	61	62	64	73	74	75	75	76	80	77	77	
6300	60	60	62	70	72	73	73	74	79	76	76	
8000	60	60	62	71	71	73	73	73	80	77	77	
10000	59	60	61	69	69	70	70	72	78	75	75	
12500	59	59	60	69	68	69	70	72	78	74	74	
16000	61	61	62	69	69	70	71	73	78	75	75	
OVERALL	109	110	113	113	112	113	113	110	117	112	112	
LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.												

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											
2 1/3 OCTAVE BAND											
NOISE SOURCE/SUBJECT: (OPERATION:)											
QU-228 AIRCRAFT ()											
INFLIGHT NOISE LEVELS ()											
IDENTIFICATION:)											
OMEGA 3.2											
TEST 71-014-056											
RUN 02											
10 JAN 75											
PAGE F2											
LOCATION/CONDITION											
FREQ (HZ)	1/K	1/L	1/M	1/N	1/P	1/Q	1/R	1/S	1/T		
25	94	93	92	93	92	91	90	93	92		
31.5	100	100	98	98	98	99	97	98	97		
40	98	94	94	98	100	98	97	100	98		
50	94	94	92	91	92	95	95	93	96		
63	97	94	91	90	91	94	95	92	94		
80	114	100	99	100	100	97	101	100	97		
100	107	111	107	106	105	103	103	107	101		
125	102	103	100	102	101	99	98	102	98		
160	104	101	102	99	104	100	102	102	96		
200	102	103	105	98	97	95	97	99	105		
250	93	98	98	99	105	102	103	106	98		
315	94	97	92	92	93	91	92	93	91		
400	92	97	92	92	92	91	90	92	86		
500	91	98	91	92	90	89	89	91	84		
630	90	96	90	90	89	90	88	90	85		
800	88	94	88	87	86	86	85	87	83		
1000	86	92	85	84	83	82	81	84	79		
1250	84	90	83	82	81	80	79	81	76		
1600	82	89	82	81	79	78	78	79	75		
2000	84	89	84	83	82	80	80	82	78		
2500	84	89	82	81	79	77	78	80	76		
3150	83	90	82	79	78	77	77	78	75		
4000	84	91	84	81	80	77	78	80	76		
5000	81	88	80	79	77	75	75	77	73		
6300	81	89	79	77	75	73	73	75	72		
8000	81	90	80	78	75	72	74	74	72		
10000	79	88	78	76	75	71	72	73	69		
12500	79	88	78	77	75	70	72	72	69		
16000	79	87	77	76	75	70	72	72	69		
OVERALL	116	114	111	110	111	109	110	112	109		
LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.											

[illegible]

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)										
2										
OCTAVE BAND										
IDENTIFICATION:										
NOISE SOURCE/SUBJECT:										
OPERATION:										
QU-22B AIRCRAFT										
INFLIGHT NOISE LEVELS										
LOCATION/CONDITION										
1/K 1/L 1/M 1/N 1/P 1/Q 1/R 1/S 1/T										
FREQ (HZ)										
31.5	103	101	100	101	103	102	101	102	101	101
63	114	102	100	101	101	100	102	101	101	100
125	109	112	108	108	108	106	106	109	109	103
250	103	105	106	102	106	103	104	107	107	106
500	96	102	96	96	95	94	94	96	96	90
1000	91	97	91	89	88	88	87	89	89	85
2000	88	94	87	86	85	83	83	85	85	81
4000	88	94	87	84	83	81	82	83	83	80
8000	85	94	84	82	80	77	78	79	79	76
16000	82	90	81	79	78	73	75	75	75	72
OVERALL	116	114	111	110	111	109	110	112	112	109

TABLE: MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:	
3										OMEGA 3.2	
NOISE SOURCE/SUBJECT:										TEST 71-014-056	
(OPERATION:										RUN 01	
(
QU-22B AIRCRAFT										10 JAN 75	
(
INFLIGHT NOISE LEVELS										PAGE H1	
(
LOCATION/CONDITION											
1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J		
HAZARD/PROTECTION											
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR											
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR											
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)											
NO PROTECTION											
OASLC	107	109	112	112	112	112	110	117	112		
OASLA	89	90	93	100	100	101	98	102	99		
T	202	170	101	30	30	25	42	21	36		
MINIMUM QPL EAR MUFFS											
OASLA*	82	84	89	89	90	90	88	96	90		
T	679	480	202	202	170	170	240	60	170		
V-51R EAR PLUGS											
OASLA*	70	71	74	79	79	79	77	81	78		
T	960	960	960	960	960	960	960	807	960		
FLENTS EAR PLUGS											
OASLA*	71	73	76	80	80	80	78	83	79		
T	960	960	960	960	960	960	960	571	960		
H-157 IN-FLIGHT COMMUNICATION UNIT											
OASLA*	82	84	88	90	91	91	88	95	91		
T	679	480	240	170	143	143	240	71	143		
COMMUNICATION											
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)											
PSIL	77	76	80	90	90	91	90	91	89		
ANNOYANCE											
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNOB)											
TONE CORRECTION (C IN DB)											
PNLT	107	108	113	115	116	116	114	121	116		
C	1	1	2	1	1	1	1	2	1		
* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.											

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:	
3											
NOISE SOURCE/SUBJECT:	(OPERATION:)									OMEGA 3.2	
QU-22B AIRCRAFT	()									TEST 71-014-056	
INFLIGHT NOISE LEVELS	()									RUN 02	
	()									28 APR 76	
	()									PAGE H1	

LOCATION/CONDITION											
1/K	1/L	1/M	1/N	1/P	1/Q	1/R	1/S	1/T			
HAZARD/PROTECTION											
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR											
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR											
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)											
NO PROTECTION											
OASLC	115	114	111	110	111	109	109	112	109		
OASLA	100	104	100	98	100	98	98	101	97		
T	30	15	30	42	30	42	42	25	50		
MINIMUM QPL EAR MUFFS											
OASLA*	93	92	89	88	89	86	87	89	86		
T	101	120	202	240	202	339	285	202	339		
V-51R EAR PLUGS											
OASLA*	79	81	78	77	79	77	78	80	76		
T	960	807	960	960	960	960	960	960	960		
FLENTS EAR PLUGS											
OASLA*	81	82	79	78	80	77	79	81	78		
T	807	679	960	960	960	960	960	807	960		
H-157 IN-FLIGHT COMMUNICATION UNIT											
OASLA*	93	92	90	88	90	87	89	91	88		
T	101	120	170	240	170	285	202	143	240		
COMMUNICATION											
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)											
PSIL	92	97	91	91	89	89	88	90	85		
ANNOYANCE											
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)											
TONE CORRECTION (C IN DB)											
PNLT	110	121	117	115	117	114	115	110	114		
C	1	2	1	1	2	1	1	2	1		

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.											

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.